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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY.
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MISCELLANEOUS PAPERS.

THE MORE IMPORTANT ALEYRODIDÆ INFESTING ECONOMIC PLANTS.

WITH DESCRIPTION OF A NEW SPECIES INFESTING THE ORANGE.

By A. L. QUAINTANCE,
In Charge of Deciduous Fruit Insect Investigations.

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INTRODUCTION.

Systematically the Aleyrodidæ occupy a position between the Coccidæ and Aphididæ, two families of insects containing many serious pests of agricultural and horticultural crops. Species of Aleyrodidæ are, however, with a few exceptions, not at present of especial economic importance, though many of them occur in some numbers on useful plants. Also, with few exceptions, so far as known the injurious species of this family are not yet generally distributed over the world, as are so many scale insects and aphides, possibly from the fact that the Aleyrodidæ feed exclusively on the leaves of their host plants and are thus not so likely to be distributed in shipments of trees and plants as if occurring on the twigs and branches. When once established in a locality an introduced species, as compared with scale insects, would disseminate more rapidly, since the adults of both sexes are winged, though they are not strong fliers.

The Aleyrodidæ are most abundant in tropical or semitropical regions, though species of *Aleyrodes* in the United States are fairly abundant in the Transition zone. Species of *Aleurodicus*, however, are almost exclusively tropical, and with one exception are known thus far only from the Western Hemisphere, whence it is not improbable that this species was distributed.

The family contains only two genera—*Aleyrodes* and *Aleurodicus*—and 143 species have been described to date. The literature dealing with these insects is so widely scattered that it has seemed desirable to comment briefly on the species known to infest economic plants, so that their introduction or dissemination may be better guarded against.

ECONOMIC PLANTS AND THE MORE IMPORTANT ALEYRODIDÆ INFESTING THEM.

Tobacco.—Tobacco is attacked by two species of *Aleyrodes*—namely, *A. nicotianæ* Maskell, from Mexico, and *A. tabaci* Gennadius, from Greece. The former is apparently not of much economic importance, as shown by the condition of infested leaves from Mexico. *A. tabaci* is, however, more injurious, according to Targioni-Tozzetti, who

gives a very full account of the species in his "Animali ed Ensetti del Tobacco." The insect was first noticed in 1889 on leaves from Araucania, where it was said to be spreading more and more. In the work just cited it is remarked that, save possibly for a decrease in dimensions, the leaves do not show signs of alterations, but from the quantity of insects which remain on the dry leaves the tobacco is rendered unfit for use. No method of treatment is suggested.

Sugar cane.—No aleyrodids have as yet been recorded from sugar cane in this country, but abroad certain species are pests of importance. *Aleyrodes bergii* Signoret was described in 1867 from the Isle of Mauritius, where it was found on sugar cane. In Java this same species is at present a serious pest of cane, and there it has been carefully studied by Dr. L. Zehntner and reported on in the Archief Java Suikerindustrie for 1896. Two other species infest sugar cane in Java—namely, *Aleyrodes longicornis* Zehntner and *A. lactea* Zehntner, the former being quite destructive. These species have also been fully treated by Zehntner in the "Archief" for 1899. The remedial measures practiced consist in cutting off and burning the infested leaves, and spraying with milk of lime, which is said to destroy the immature insects, but not the developed parasite within the pupa case—*Ablerus pulchriceps* Zehntner, which attacks *longicornis*. *Aleyrodes lactea* is also attacked by the fungus *Aschersonia aleyrodis* Webber, or a very similar species, which attacks *Aleyrodes citri* in this country. *Aleyrodes sacchari* Maskell occurs on sugar cane in Fiji, and *A. barodensis* Maskell was received by Maskell from Baroda, India, with the advice that the insects were rather damaging to sugar cane in those parts.

Orange.—Of the several aleyrodids attacking the orange, *Aleyrodes citri* Riley and Howard is much the most important. In Florida especially this species at the present time is doubtless the most important of all of the insect pests of this crop, and it is also the subject of frequent complaint from southern Louisiana and to a less extent from southeastern Texas. The literature of this species is considerable, and its life history has been carefully worked out. Some important papers are: "The Orange Aleyrodes," by Riley and Howard (Ins. Life, Vol. V, p. 219); "Sooty Mold of the Orange and its Treatment," by H. J. Webber (Bull. 13, Div. Veg. Phys. and Pathol., U. S. Dept. Agric.); "The White Fly," by H. A. Gossard (Bull. 67, Fla. Agric. Exp. Sta.), and "White Fly Conditions in 1906, etc.," by E. W. Berger (Bull. 88, Fla. Agric. Exp. Sta.). At the present time the insect is the subject of a special investigation by the Bureau of Entomology. *Aleyrodes floridensis* Quaintance, more common on guava in Florida, also occurs on the orange, but on this latter plant it has not yet proved to be of special economic importance. In Arizona Prof. T. D. A. Cockerell has found on orange a form of *Aleyrodes mori* Quaintance which he has given the

varietal name *arizonensis*. *Aleyrodes aurantii* Maskell was described from specimens on orange from the northwest Himalayas, the leaves received by Maskell being thickly covered with the pupa cases. *Aleyrodes marlatti* Quaintance occurs on orange in Japan, and *A. spinifer* Quaintance on *Citrus* sp. and rose in Java.

For the past three or four years the Bureau of Entomology has received from Cuba orange leaves infested with an undescribed species of *Aleyrodes*, the description of which is given herewith:

Aleyrodes howardi n. sp.

(Plate VII; text figs. 23, 24.)

Egg.—Uniform brownish in color, without reticulations, curved; size about 0.18×0.09 mm. Stalk short, eggs lying prostrate on leaf, arranged more or less in circles or curves.

Larva.—Color and structure essentially as in pupa case.

Pupa case.—Size about 0.9×0.55 mm., subelliptical in shape. Many specimens with more or less evident indentures on cephalo-lateral margin of case, with cephalic end obtusely pointed. Color on leaf under hand lens with secretion removed, yellowish brown varying to blackish; under transmitted light yellowish to brownish yellow. There is a distinct marginal rim all around, with wax-tubes distinct, the incisions acute and tubes rounded distally. From margin of case all around arises a short rim of wax, composed of individual wax threads, serrated on margin as seen under a high power of microscope. Case usually quite covered by a very copious secretion of grayish, curling wax rods, which is very conspicuous on badly infested leaves, quite hiding the insects beneath (Pl. VII, fig. 1; text fig. 23). Denuded of secretion, pupa case is seen to be at first almost flat, but later becoming rather convex as the insect develops, with segments distinct.

FIG. 23.—*Aleyrodes howardi*, showing copious secretion from pupæ, on lower surface of orange leaf. (Original.)

Dorsum with pair of strong setæ on first abdominal segment, a pair at vasiform orifice, and a pair at caudal margin extending some distance beyond margin of case. Vasiform orifice relatively small, subcordate, the rim dark brown, from 6 to 8 strong setæ or spines arising from caudal margin; operculum largely filling orifice, the distal margin with 2 faint notches; lingula not distinguishable (see fig. 24).

Adult female.—Usual; body yellow, wings immaculate; length of body about 0.84 mm.; hind tibiæ, 0.35 mm.; fore wing, 1 mm. long by 0.36 mm. wide. Hind tarsus, 0.16 mm.

Male.—Not seen.

Food plant.—Orange. Collected at Artamisa, Cuba, February 5, 1905, by C. L. Marlatt, and at Habana, Cuba, February 19, 1903, by E. A. Schwarz. Received from Dr. Mel. T. Cook, June 6, 1905, from Santiago de las Vegas, Cuba.

Judging from the abundance of this insect on orange leaves received from the above-mentioned sources, this is a very serious pest

of the orange, perhaps rivaling the so-called white fly of Florida (*Aleyrodes citri* Riley and Howard).

Described from numerous infested leaves, pupa cases in balsam mounts, and two females.

Type.—No. 10821, U. S. National Museum. Named for Dr. L. O. Howard.

Cotton.—*Aleyrodes gossypii* Fitch, described in Fitch's Third Report, is known only from the single type specimen on *Gossypium religiosum* from Ningpo, China. The second species is *Aleyrodes abutilonea* Haldeman, of which *A. fitchi* Quaintance appears to be a synonym. This species has been found on cotton at Harrisville, Miss.; Selma, Ala., and Columbus, Tex. At the place first mentioned the insects were very abundant, the lower surface of the leaves being covered with the pupa cases. The insect was also taken by Riley on cotton growing in his garden at Washington, D. C., and in Delaware, Maryland, and Virginia it occurs very abundantly on *Abutilon abutilon*, probably its native food plant, which it greatly injures, and is thus beneficial, since this plant is a troublesome weed.

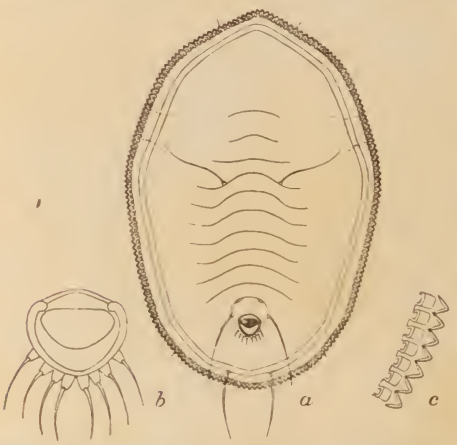

Fig. 24.—*Aleyrodes howardi*: Pupa case and details. Greatly enlarged (original).

Guava.—In Florida *Aleyrodes floridensis* Quaintance is quite common on the guava, the under surface of leaves sometimes being quite covered with the pupa cases. In Brazil *Aleyrodes horridus* Hempel and *A. goyabæ* Göldi occur on this plant, the latter often by hundreds, constituting a serious pest. *Aleurodicus cocois* Curtis infests guava in Trinidad, Venezuela, and Brazil. Guava is also infested by *A. cockerelli* in Brazil, and by *A. holmesii* Maskell in Fiji, which Cockerell thinks has there been introduced from America along with its food plant.

Cocoanut.—In Demerara and Barbados the cocoanut palm for many years has been seriously injured by *Aleurodicus cocois* Curtis, which, in company with a scale insect, was held responsible for a widespread disease of the trees on the latter island. This species was the subject of an article by Riley and Howard in Insect Life, Volume V, page 314 (1893). At the time this article was written, the introduction of this species into southern Florida on cocoanut, and guava, which it also infests, was considered only a matter of time, if not already accomplished. Thus far, however, nothing has been recorded of its occurrence in that State.

ECONOMIC ALEYRODIDÆ.

Fig. 1.—*Aleyrodes howardi*, on orange. Fig. 2.—*Aleyrodes anonæ*. Fig. 3.—*Aleyrodes vaporariorum*, on tobacco.

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CUSTARD APPLE (*Anona* spp.).—In Demerara *Anona muricata* and *A. squamosa*, and in Trinidad *A. reticulata*, are often seriously infested with *Aleurodicus anonæ* Morgan, and this same species has been reported on *Anona* from Pernambuco, Brazil. This species is remarkable from the large amount of cottony substance secreted, the under surface of badly infested leaves being thickly covered with it (see Pl. VII, fig. 2). *A. mirabilis* Cockerell occurs on *Anona* sp. in Mexico, and *Aleyrodes lacerdæ* Signoret is recorded from *Anona sylvatica*, the locality not being stated.

STRAWBERRY.—*Aleyrodes packardi* Morrill is troublesome to strawberries, according to Morrill, and occurs in Ohio, Kentucky, southeastern New York, and Connecticut. Until the investigations of Doctor Morrill this species had been referred to *A. vaporariorum* Westwood, which it resembles. This and the greenhouse Aleyrodes (*A. vaporariorum*) are the subject of a valuable paper by Morrill published as Technical Bulletin No. 1 of the Massachusetts Hatch Experiment Station. *A. fernaldi* Morrill is also recorded from strawberry, though more abundant on Spiræa. In Europe *A. fragariæ* Walker occurs on strawberry, according to Walker, in myriads during July, but in France, as stated by Signoret, it is less numerous.

CABBAGE.—In Europe *Aleyrodes brassicæ* Walker has long been known as more or less injurious to cabbage, kale, and other members of this family. According to C. W. Dale, and reported by J. W. Douglas, it is common on the indigenous wild cabbage which grows on the coast of the Isle of Purbeck, and the species is not to be regarded as imported and naturalized on cabbage cultivated in gardens. In Brazil, State of Sao Paulo, *Aleyrodes youngi* Hempel infests cabbage, the injury being considerable, as the infested leaves become yellow, wilted, and covered with a white powder, and are thus rendered unfit for use.

GREENHOUSE PLANTS.—Several species of aleyrodids are known to infest plants in greenhouses, notably *Aleyrodes vaporariorum* Westwood, which in some sections of the North, as Massachusetts and Connecticut, constitutes a serious drawback to the growing under glass of such vegetables as tomatoes, cucumbers, and melons, and to such flowering plants as *Ageratum*, *Lantana*, and heliotrope. This species is a very general feeder, attacking plants representing several botanical families (see Pl. VII, fig. 3). An undetermined species having banded wings infests tomatoes and other vegetables under glass, and to some extent out of doors, in Florida. *Aleyrodes nephrolepidis* Quaintance occurs on a fern, *Nephrolepis*, thus far reported only from the conservatory of the Pennsylvania State College, where it evidently has been introduced. According to Professor Butz the adults were very abundant, flying around in the conservatory. Other aleyrodids occurring on ferns are *Aleyrodes filicium* Göldi, on *Asplenium cuneatum*,

and other Brazilian ferns, in the botanic gardens at Rio de Janeiro; and the same species has been reported on *Oleander articulata* and *Pteris quadriolata* in the Fern House, Kew Gardens, in England. *Aleyrodes asplenii* Maskell occurs on *Asplenium lucidum* and other ferns in New Zealand, though whether in conservatories or not is not indicated. *Aleyrodes citri* Riley and Howard is fairly common on citrus plants in greenhouses, though rarely troublesome. In Florida *A. rolfsii* Quaintance infests geranium in injurious numbers out of doors, and might become a pest to this plant in greenhouses if there introduced.

Rubus spp.—*Aleyrodes ruborum* Cockerell seriously infests a cultivated *Rubus*, *R. trivialis*, in Florida, and occurs scatteringly on a wild blackberry, *R. cuneifolius*. In France, Signoret found a species occurring in numbers on *R. fruticosus*, which he described as *A. rubi*, and in England *A. rubicola* has been described by Douglas, infesting a *Rubus* growing in a sheltered situation.

Currant.—*Aleyrodes ribium* Douglas occurs on red and black currants in England. This is possibly the same species which infests *Vaccinium uliginosum* in Germany.

Prunus spp.—Peaches and plums are at times infested with *Aleyrodes pergandei* Quaintance, the only aleyrodid recorded from these plants. It also occurs on Crataegus and wild crab-apple, though it is never injurious so far as yet reported.

Fig.—No aleyrodids are recorded from the cultivated fig, *Ficus carica*, but in India *Aleyrodes alcocki* Peal occurs very abundantly, especially after the rainy season, on young plants of *Ficus indica* and *F. religiosa*. These plants, from the fact that they take root on old buildings and similar situations, become a nuisance, and the insects are therefore regarded as beneficial by Mr. Peal, who expresses regret that the pupæ are so badly parasitized by a small yellow chalcidid fly.

Bamboo.—Various species of bamboo in the vicinity of Calcutta are infested with *Aleyrodes bambusæ* Peal. As a rule, according to Mr. Peal, only a few leaves in a bamboo clump are attacked, but the insect sometimes occurs in large numbers, killing the leaves.

Indigo.—*Aleyrodes leakii* Peal occurs on *Indigofera tinctoria* and *I. arrecta*, Behar, India, being more common on the latter plant. Need for its control is considered likely with the increased cultivation of these plants for commercial purposes.

Betel.—*Piper betle*, a pepper, the leaves of which are chewed by natives of Eastern countries with the betel nut, is attacked in Bakarganj, India, by *Aleyrodes nubilans* of Buckton, by whom it is reported as doing considerable injury.

Grape.—An undetermined *Aleyrodes* has recently been received on vinifera grape from Fred. W. Maskew, Marysville, Cal.

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